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THE ORIGIN OF THE AVIFAUNA OF THE BAHAMAS.

BY FRANK M. CHAPMAN.

SO far as the relationships of the islands themselves are concerned the Bahaman group offers from the zoological standpoint an apparently simple case. As a coral formation arising from the Bahaman banks we may regard them as oceanic and of independent origin. In an analysis of their fauna, therefore, we are not confronted by the perplexing problems which beset us in studying the larger West Indian Islands, where a probable connection with the mainland greatly enlarges the scope of our inquiry, and renders more involved the questions to be determined. Here, however, we have an area which has not been populated by a past connection with contiguous regions, but owes its life to the more or less fortuitous occurrence of the ancestors of the species which now inhabit it. Primarily through the resulting isolation the original forms have in many instances become evolved into what we term new species, whose range is restricted to one or more of the islands in question. The Bahamas possess no indigenous terrestrial Mammalia, and thus conform to the law which generally obtains among oceanic islands. The two or three species of Mus which are found there have evidently been introduced through artificial means.

Birds, however, possessing in their power of flight a most effective means for extended wanderings, have found the intervening waters no bar to their occupation of the Bahamas. The islands furnish them with resting places in their migrations, with homes during the rigors of a northern winter, with breeding grounds during the summer, or with a permanent habitat, beyond which they are unknown.

We may imagine these islands as at first barren coral reefs and sand-bars, tenanted alone by gulls, terns, and other pelagic species, as indeed some of the islands are now. But, devoid of a vegetation which, through its fruit or support of insect life, would furnish food, no land bird could exist there. Increasing vegetation finally rendering them habitable, they were ready to receive the first-comers of a future avifauna. This, as we shall see, has been supplied from various sources, and there have now been recorded from the Bahamas about one-hundred-and-fifty-six species and subspecies of birds. The influences which have been most active in producing this fauna we may discuss after we have reviewed the fauna itself.

Of the one-hundred-and-fifty-six species, seventy-two are water-birds of generally wide distribution, and, with two exceptions, we may dismiss them at once as in no way distinctively Bahaman. The remaining eighty-four land birds we may divide into non-breeding and breeding birds. The first class, or non-breeders, is composed of thirty North American species which find in the Bahamas either a winter home or a pathway for their migrations to and from the tropics. Although, as we have said, the islands afford many of these species congenial homes during the winter, the migratory habit is evidently too strongly developed to permit of their becoming permanent residents. Unless, therefore, they are residents in the same latitude on the mainland, apparently in no instance have they assisted in populating the Bahamas.

It is the second class, however, of breeding birds which claims our especial attention. Here it is we shall find the truly Bahaman species which give character to the avifauna. We owe our knowledge of this avifauna largely to the original investigations of Dr. Bryant, Mr. Cory, the naturalists of the "Albatross," and to Dr. Northrop. It is, however, far from complete. Several islands have as yet been unexplored, and we need more exact information concerning the distribution of many species. Dr. Northrop's recent paper on the birds of Andros is an important step in this direction, and his success in this field may well stimulate and encourage other workers. So far as we at present know, fifty-four species of land birds may be considered as breeding in the Bahamas. In our study of their relationships we may include two species of water birds whose comparatively sedentary habits have promoted their differentiation into Bahaman forms. These birds we may divide into two classes:

the first consisting of species of more or less general distribution, and not confined to the Bahamas; the second consisting of species and subspecies peculiar to the islands, beyond which they are, as a rule, unknown. The first class numbers thirty-two species, which may be summarized according to their distribution, as follows :

Cosmopolitan.—1, *Circus hudsonius ;* 2, *Falco peregrinus anatum ;* 3, *Pandion haliaëtus carolinensis ;* 4, *Strix pratincola.*

Continental.—1, *Cathartes aura ;* 2, *Falco sparverius ;* 3, *Ceryle alcyon.*

North American.[1]—1, *Accipiter velox;* 2, *Antrostomus carolinensis ;* 3, *Agelaius phœniceus bryanti ;* 4, *Ammodromus savarnarum passerinus ;* 5, *Dendrœca vigorsii ;* 6, *Mimus polyglottus.*

Tropical.—1, *Columba leucocephala ;* 2, *Columbigallina passerina ;* 3, *Zenaida zenaida ;* 4, *Geotrygon montana ;* 5, *Crotophaga ani ;* 6, *Tyrannus domenicensis.*

West Indian.—1, *Chordeiles minor;* 2, *Euethia bicolor.*

Cuban.—1, *Chrysotis leucocephala ;* 2, *Sporadinus ricordii ;* 3, *Tyrannus magnirostris ;*[2] 4, *Vireo altiloquus barbatulus ;* 5, *Dendrœca petechia gundlachii ;* 6, *Mimus gundlachii.*

Haytian.—1, *Speotyto cunicularia dominicensis.* 2, *Loxigilla violacea ;*[3] 3, *Dendrœca petechia ;*[2 3] 4, *Mimus elegans.*[2]

Porto Rica and Northern Windward Islands.—1, *Margarops fuscatus.*[2]

The second class numbers twenty-four endemic species and subspecies. In attempting to explain their specific affinities we shall be obliged to consider each one in connection with its allies.

1. *Rallus coryi.*—Known from two specimens taken on Andros. It is closely related to the *Rallus longirostris* group of rails of continental distribution.

2. *Ardea bahamensis.*—Found throughout the Bahamas. It is nearly allied to the North American *Ardea virescens*, which, ranging from Northern South America to Canada, is subject to more or less variation under favorable conditions.

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[1] The species here given are all residents in Florida.

[2] Recorded only from Inagua.

[3] Occurs also in Jamaica.

3. *Coccyzus minor maynardii.*—A resident representative of *Coccyzus minor*, a species of general distribution throughout the West Indies and coasts of the surrounding mainland. In Southern Florida it occurs only as a summer resident, and is not there distinguishable from the Bahaman bird.

4. *Saurothera bahamensis.*—Known only from Andros and New Providence. Allied species of this very distinct West Indian genus occur in Cuba, Jamaica, Hayti, and Porto Rica. The Bahaman species most closely resembles *Saurothera vieilloti* of Porto Rica. When we consider the limited power of flight now possessed by this species (Dr. Northrop states that he was told they could be captured after a short chase),[4] its appearance in the Bahamas is certainly remarkable. Nor can we here argue loss of flight-power through the influences of an insular existence, for the bird's congeners are no better adapted for extended journeys.

5. *Dryobates villosus maynardii.*—A common resident of Andros, New Providence, and Abaco. It differs very slightly from the Florida form, *Dryobates villosus audubonii.*

6. *Centurus nylanus.*

7. *Centurus blakei.*—This is one of five instances in which a Bahaman form has become further separated into two or more forms inhabiting different islands. *Centurus nylanus* is found on Wattling's Island, while *C. blakei* is known only from Abaco. They are closely related to each other, and also to their obvious ancestor the Cuban *Centurus superciliaris.*

8. *Doricha lyrura.*

9. *Doricha evelynæ.*—The first of these nearly related species is apparently restricted to Inaugua and Long Islands; the second has a wider range, and has been found on most of the remaining islands. The genus Doricha is Central American, and not elsewhere represented in the West Indies. The presence of these two species in the Bahamas is, therefore, not easily accounted for. *Doricha elizæ*, the most northern species on the mainland, is found in the vicinity of Jalapa. The Bahaman birds, however, more closely resemble *D. bryanti* of Costa Rica.

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[4] *The Auk*, VIII., 1891, p. 74.

10. *Myiarchus lucaysiensis.*—This fly-catcher is evidently derived from the Cuban *Myiarchus sagræ*; indeed, some authors consider the birds inseparable.

11. *Blacicus bahamensis.*—A near relative of a West Indian group of fly-catchers, and probably closest to the Cuban *Blacicus carribeus.*

12. *Pitangus bahamensis.*—Related species occur on the four larger West Indian Islands. The Bahaman bird is probably nearest the Cuban *Pitangus caudifasciatus.*

13. *Icterus northropi.*—A well-marked species, known as yet only from Andros, where its discover, Dr. Northrop, found it not uncommon. It is an evident representative of the Haytian *Icterus dominicensis.*

14. *Spindalis zena.*

15. *Spindalis zena townsendii.*—The distribution and relationships of these birds are particularly interesting. The first is found in Andros, the second is apparently restricted to Abaco, while on the intervening island, New Providence, an intermediate and connecting form occurs. Spindalis is a characteristic West Indian genus; Cuba, Grand Cayman, Jamaica, Hayti, and Porto Rica each have distinct species, and quite recently a well-marked species has been described from Cozumel. Strange to say, the more northern of the Bahaman birds, *Spindalis zena townsendii* of Abaco, finds its nearest ally in this Cozumel species.

16. *Vireo crassirostris.*

17. *Vireo crassirostris flavescens.*—The center from which the species of this group of Vireos have originated is now difficult to determine. Their exact relationships to the North American *Vireo noveboracensis* and the Cuban *Vireo gundlachii* can be only questions of uncertain speculation. However, without determining their origin, we have in them a marked instance of the appearance of similar types in widely separated regions. *Vireo crassirostris* occurs in the western Bahaman Islands, subspecies *V. flavescens* in the eastern members of the group. Cuba has no near representative, but southward, on the island of Grand Cayman, we find *Vireo allenii*, a race so nearly resembling *V. c. flavescens* that Mr. Cory considers them to be inseparable. On

the mainlands at Yucatan the species reappears in *Vireo ochraceus*, which, although decidedly smaller than the island birds, exactly resembles them in coloration. On the islands of Old Providence, 250 miles north of Aspinwall, the species again is found, but here is nearer the West Bahama bird, *V. crassirostris*.

18. *Callichelidon cyaneoviridis.*—Callichelidon is the only genus of birds peculiar to the Bahamas. That this single instance should be among the swallows, birds possessing great power of flight, and generally having extended habitats, is indeed most remarkable. Mr. Scott's recent capture of this species in the Tortugas[5] is, so far as we know, the only occasion on which it has been found beyond the Bahamas. It has not been recorded from Cuba, and this is one of a number of cases where species which should occur there have not been recorded from that island. Indeed, our knowledge of Cuban birds may well be supplemented by much additional information before it can be considered complete. As has been said, *C. cyaneoviridis* in its generic distinctness stands alone among Bahaman birds, and unless it is a survivor of a once more widely distributed species it is difficult to give even a probable theory of its origin. It has no near West Indian relatives, unless the very different *Tachycineta euchrysea* of Hayti be considered as such, and it is perhaps as near to *Tachycineta thalassina* of Northern North America as to any other species.

19. *Certhiola bahamensis.*—One of a very distinct group of three species of peculiar distribution. *Certhiola caboti*, very closely related to *bahamensis*, is found in Cozumel, while the remaining species, *C. tricolor*, which inhabits the island of Old Providence, is nearer to *bahamensis* than to *caboti*.

20. *Geothlypis rostrata.*

21. *Geothlypis coryi.*

22. *Geothlypis tannerii.*—Three closely related forms inhabiting respectively the islands of New Providence, Eleuthera, and Abaco. Additional material will doubtless show, as Mr. Allen states, that the bird from Andros will constitue a fourth form. This is the fifth and by far the most interesting instance in which an

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[5] *The Auk*, VII., 1890, p. 265.

established Bahaman species has become further divided into several insular races.

The genus Geothlypis is not found in the West Indies, and we are forced to consider the very distinct *Geothlypis trichas ignota* of Florida as the probable ancestor of the *rostrata* group. The supposition becomes more probable when we consider that *ignota*, in having a larger bill and more yellow below than the North American *Geothlypis trichas*, thus presents a distinct step towards the Bahaman species. In other words, although more nearly related to *trichas*, *ignota* is in a degree intermediate between it and *rostrata*. We dwell on this because the origin of the Bahaman bird is of special importance, although being evidently derived from the Florida form, it more nearly resembles, indeed is very similar to, *Geothlypis beldingii* of Lower California. Thus we find that quite independently of each other two birds whose habitats are separated by a continent have been evolved to almost specific identity. This instance is of great value in studying the relations of island faunæ, where the same type may appear on widely separated islands, and be replaced on intervening islands by a nearly related but still different species. We have noted somewhat similar cases in our remarks on Spindalis and *Vireo crassirostris* and Certhiola. May we not assume here that the intervening species is a common ancestor, and that by similar lines of divergence two forms have been produced which are more nearly related to each other than they are to the parent stock ?

23. *Polioptila cœrulea cœsiogaster.*—A form differing very slightly from *P. cœrulea*, which occurs both in Florida and Cuba.

24. *Mimocichla plumbea.*—A species closely related to *Mimocichla schistacea* of Cuba.

LIST OF BIRDS PECULIAR TO THE BAHAMAS, WITH THE SPECIES WHICH THEY APPARENTLY REPRESENT.

BAHAMAN SPECIES.	REPRESENTED SPECIES.
Rallus coryi.	*Rallus longirostris* group (Continental).
Ardea bahamensis.	*Ardea virescens* (Continental).
Coccyzus minor maynardi.	*Coccyzus minor* (Tropical).
Saurothera bahamensis.	*Saurothera vieillotii* (Porto Rica).

Dryobates villosus maynardii.	*Dryobates villosus audubonii* (Florida).
Centurus nylanus (Wattling's Island). *Centurus blakei* (Abaco).	*Centurus superciliaris* (Cuba).
Doricha lyrura (Inaugua, Long Island). *Doricha evelynæ* (Andros, New Providence, Abaco).	*Doricha bryantii* (Costa Rica).
Myiarchus lucaysiensis.	*Myiarchus sagræ* (Cuba).
Blacicus bahamensis.	*Blacicus barbirostris* group (Cuba, Hayti, etc).
Pitangus bahamensis.	*Pitangus caudifasciatus* group (Cuba, Jamaica, and Hayti).
Icterus northropii.	*Icterus domenicensis* (Hayti).
Spindalis zena. *Spindalis zena townsendii.*	*Spindalis pretrei* (Cuba).
Vireo crassirostris. *Vireo crassirostris allenii.*	(?)
Callichelidon cyaneoviridis.	(?)
Certhiola bahamensis.	*Certhiolo caboti* (Cozumel).
Geothlypis rostrata (New Providence). *Geothlypis coryi* (Eleuthera). *Geothlypis tannerii* (Abaco).	*Geothlypis trichas ignota* (Florida).
Polioptila cærulea cæsiogaster.	*Polioptila cærulea* (Cuba, Florida).
Mimocichla plumbea.	*Mimocichla schistacea* (Cuba.)

This completes our review of the endemic species and subspecies. We may now classify them according to the distribution of their apparent ancestors, and placing them with the land birds previously given as not peculiar to the Bahamas, summarize the avifauna exclusive of water birds, as follows. Bahaman forms obviously derived from the same ancestor, or from each other, are here included as one :

HABITAT AND NUMBER OF REPRESENTED SPECIES.		ENDEMIC.	NON-ENDEMIC.
Cosmopolitan,	4	0	4
Continental,	5	2	3
North American,	5	0	5
Floridan,	3	2	1
Tropical,	8	2	6

West Indian,	2	0	2
Cuban,	12	6	6
Haytian,	5	1	4
Porto Rican,	2	1	1
Central American,	2	2	0
Uncertain,	2	2	0

We have said that the formation of the fauna we have just reviewed has, in the case of the land-bird element, been caused by more or less fortuitous circumstances. This in a measure is true. Inaugua on the south is distant from Cuba and Hayti about fifty miles, Great Bahama on the north is distant from Florida sixty miles, while these islands are situated respectively thirty and ten miles from their nearest neighbors in the group. These in turn are separated from others by varying distances, never greater, however, than the distances first mentioned. Of Great Bahama we know nothing; no ornithologist has ever visited it. Of Inaugua, we have some knowledge, and it has apparently served as a gateway for many species of West Indian origin which are now distributed throughout the Bahamas. Others, four in number, have not advanced beyond this portal. Once established on Inaugua, the most difficult step would have been taken, and future ones become comparatively easy. It is not assumed that all the Bahaman species of West Indian origin have been derived through Inaugua, though it is evident that some of them have, and we may in this way, through a northward movement among the more eastern islands, account for the distribution of the Cuban parrot, which is found on Abaco, but is unknown on Andros. We mention this island merely as a possible first step for future Bahaman birds. Our examination of the fauna renders in a degree apparent the chief cause which promoted this step.

As a rule, the land birds of oceanic islands have descended from or are non-sedentary species, whose habits render them subject to the influences of storms or trade-winds, the most potent factors in the formation of insular avifauna. For this reason we should not expect to find species of especially sedentary disposition forming a prominent part of an island fauna. Sedentary is not used here as meaning non-migratory alone, but also refers to those species which, being non-migratory, are at the same time species of retiring habits,—that is, are terrestrial or thicket-loving, and do not, as a rule, make extended flights. It is obvious that birds of this character would not be exposed to the action of storms and gales, and we rarely find them inhabiting islands. Wrens are excellent examples, and with the exception of a small group found on the southern Windward Islands, are unknown from the West Indies, although they are abundant on all the surrounding mainlands. The Carolina wren, one of the most common birds of Florida, has never been found in the Bahamas, nor indeed in Cuba. On examining the Bahama fauna, therefore, we find that the birds, although resident now, are descendants of, or are co-specific with, either migratory species or species whose non-sedentary habits have rendered them susceptible to the influences of that island populator, the wind, to which many Bahaman birds doubtless owe their original appearance on the islands. But we have also found that the descendants of the migratory species which have become endemic are residents in the same latitude on the mainlands. Birds of strictly migratory habits, therefore, are not apt to form a part of island life, unless the islands occur near the limits of their breeding habitats. The Bermudas are annually visited by large numbers of South American migrants, but the number of resident land birds is restricted to six.

Thus the Bahamas do not owe their avifauna to purely migratory species, but to the occurrence there of resident species from generally contiguous areas; and their original appearance may have been due to a gradual extension of range, or, as we have said, to their accidental occurrence through the influence of violent winds. With the exception of two bi-continental species, which throughout their ranges are subject to local specialization under favorable conditions, the endemic Bahaman birds are derived from species which in their generally limited ranges and close relationships with other species prove their susceptibility to the influences of their surroundings.

As to the causes which have produced differentiation in the forms we have just discussed, we can say very little. We may assume that changed conditions of environment acting on isolated species have resulted in their evolution into new species, presumably better adapted to their surroundings. But just what conditions have effected a given result we do not know. In the further division of a Bahaman species into two or more races the case becomes even more perplexing. We have not, then, different physiographic or climatic conditions to the influences of which we may ascribe observed changes. On the contrary, we find different forms of the same species inhabiting islands almost within sight of each other, where they are apparently subjected to similar conditions of existence. In several instances these differences, though here constant and characteristic, are not greater than those presented by individual variation in a larger series of a given species from one locality. Perhaps we can assume, then, that through the continued isolation of a comparatively small number of individuals certain characters, due originally to purely individual variation, have become perpetuated and specific. Among a smaller number of birds the extent of variation would, of course, be less; but this would be more than counterbalanced by the fact that any new character would be far more likely to be preserved through a forced interbreeding of closely related individuals.

Of the age of the Bahaman avifauna we can, of course, judge only by comparison. But the conditions which govern any given areas vary so greatly that even in this way we can form only an approximate idea of the relative age of their faunæ.

The isolation afforded by insular existence in tending to preserve new characters would at the same time hasten the consummation of permanent forms. The rate of divergence, therefore, is, without doubt, more rapid among island-inhabiting species than among those confined to the mainland.

From the comparative ease with which we have been able to trace the specific relationships of most of the endemic birds, and, with one exception, from the absence of peculiar genera, it is probable that the Bahaman avifauna is of recent origin. Being so largely derived from, it is, of course, more recent than, that of the larger West Indian Islands, where sixteen endemic genera occur; indeed, is not so old as the avifauna of the Windward group, where seven endemic genera are found. Perhaps in distinctness from related species the avifauna may be compared with that of Grand Cayman, an island situated 175 miles south of Cuba, and 200 miles northwest of Jamaica. The character of the formation of this island I do not know; Commander Bartlett has said of it, with Little Cayman and Misteriosa Bank, that they are the summits, fast appearing above tide-mark, of a submarine range having an average height of nearly 20,000 feet.

Through Mr. Cory's collectors and the naturalists of the "Albatross" Grand Cayman has been thoroughly explored, and fifteen endemic species and subspecies have been found there. These are largely derived from Cuban birds, and eleven of them are generically represented in the Bahamas.

From this review of Bahaman bird life we may presume to offer the following conclusions:

First.—The Bahamas are largely West Indian in their affinities, and the group of islands may claim the rank of a fauna of the Antillean region, characterized by the presence of forms differentiated from their West Indian ancestry and by the infusion of a slight Floridan element.

Second.—A greater number of endemic species have been derived from Cuba than from any other region.

Third.—North American migrant species which breed in higher latitudes, while occurring in great numbers in the Bahamas, at certain seasons of the year, have not assisted in forming the resident avifauna.

Fourth.—The avifauna is of comparatively recent origin.

Fifth.—Forms of a common ancestor may be differentiated from this ancestor in much the same manner, and thus, though having widely separated habitats, more closely resemble each other than they do the parent species.

Sixth.—In several instances certain Bahaman forms inhabiting contiguous islands have become differentiated from each other without, so far as we can observe, being subjected to changed climatic or physiographic conditions.

Seventh.—We may, perhaps, assume from this that these birds originally owe their characters to individual variations which, among a number of individuals, have become permanent.